It's need to note, this additive model of interacted «concentration waves» are may be used for prediction of CM tribologic properties in some systems [5–7].

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«CONCENTRATION WAVES» MODEL FOR THE TRIBOLOGIC SYSTEM CM1/°/CM2

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Model of non-interacted «concentration waves». In simple case the tribologic system from two compositional materials (CM1 and CM2) may be presented by following scheme CM1/°/CM2, where the symbol ° is denotes the «third body» without liquid lubricant. The composition of «third body» is the rezult of the «concentration waves» addition from CM1 and CM2. Then the friction coefficient and the sum velocity of linear wear are the following:

$$f = \left(I_1/(I_1+I_2)\right)f_1^{o} + \left(I_2/(I_1+I_2)\right)f_2^{o} = \left(I_1 f_1^{o} + I_2 f_2^{o}\right)/\left(I_1+I_2\right);$$

$$I_1 + I_2 = I_1^{o} + I_2^{o},$$

where $\left(f_1^{o}, I_1^{o}\right)$ and $\left(f_2^{o}, I_2^{o}\right)$ are the tribologic properties of the CM1 and CM2 in the CM1/°/CM1 and CM2/°/CM2 systems, accordingly. The CM1 tribologic properties are may be calculated by next formulae:

$$f = \left(I_1 f_1^{o} + I_2 f_2^{o}\right)/\left(I_1^{o} + I_2^{o}\right);$$

$$I_1 = \left(f_1^{o} - f\right)\left(I_1^{o} + I_2^{o}\right)/\left(f_1^{o} - f_2^{o}\right);$$

$$I_2 = \left(f - f_2^{o}\right)\left(I_1^{o} + I_2^{o}\right)/\left(f_1^{o} - f_2^{o}\right).$$

If the relative synergic effect for each CM is the next relation:

$$\delta_i = 4\alpha_i^2\left(1-\alpha_i\right)\left[1 - k_i\left(1 - k_{n,i}\right)\right] \cong 2\alpha_i^2\left(1-\alpha_i\right)$$

(by $\alpha = \alpha_i$ and $k_i \cong 0{,}5$; $k_{n,i} \cong 0$),

the common synergic effect may be determined by following form: $\langle\delta\rangle = 2\langle\alpha^2\rangle(1 - \langle\alpha\rangle)$, where: $\langle\alpha\rangle = \left(\alpha_1 I_1 + \alpha_2 I_2\right)/\left(I_1^{o} + I_2^{o}\right)$ is the average concentration of the CM1ÇCM2 solid components into the «third body» volume. It's note, this additive model of non-interacted «concentration waves» are may be used for prediction of CM tribologic properties in some systems [1–5].

Model of interacted «concentration waves». The tribologic properties of the compositional materials (CM) CMi (i = 1,2) in CMi/°/CMi systems are may be calculated by next relations:

$$f_i^{o} = f_{lub,i}^{o} + (\alpha_i - \delta_i)\left(f_{sol,i}^{o} - f_{lub,i}^{o}\right)$$

$$I_i^{o} = I_{lub,i}^{o} + (\alpha_i - \delta_i)\left(I_{sol,i}^{o} - I_{lub,i}^{o}\right)$$

where $\left(f_{sol,i}^{o}, I_{sol,i}^{o}\right)$ and $\left(f_{lub,i}^{o}, I_{lub,i}^{o}\right)$ are the sets of average properties values of the solid (with concentration α_i) and lubricant CMi components according to «standard scale», the symbol ° is denotes the «third body» without liquid lubricant, δ_i – are the relative synergic effect for each system.

Let's assume that the interacted «concentration waves» from each CMi are determine the composition of the «third body». Then the additive model of the friction coefficient and the sum velocity of linear wear calculation may be presented by next formulae:

$$f = f_{lub} + (\langle\alpha\rangle - \langle\delta\rangle)(f_{sol} - f_{lub});$$

$$I_i = I_{lub,i} + (\langle\alpha\rangle + \langle\delta\rangle)(I_{sol,i} - I_{lub,i}),$$

where

$$f_{lub} = \left(1 + \mu_{lub}\gamma_{lub}\right)f_{lub,2}^{o}/\left(1+\mu_{lub}\right) = \left(1 + \mu_{lub}\gamma_{lub}\right)f_{lub,1}^{o}/\left(1+\mu_{lub}\right)\gamma_{lub};$$

$$f_{sol} = \left(1 + \mu_{sol}\gamma_{sol}\right)f_{sol,2}^{o}/\left(1+\mu_{sol}\right) = \left(1 + \mu_{sol}\gamma_{sol}\right)f_{sol,1}^{o}/\left(1+\mu_{sol}\right)\gamma_{sol};$$

$$\mu_{lub} = I^{o}_{lub,1} / I^{o}_{lub,2};$$

$$\gamma_{lub} = f^{o}_{lub,1} / f^{o}_{lub,2};$$

$$\mu_{sol} = I^{o}_{sol,1} / I^{o}_{sol,2};$$

$$\gamma_{sol} = f^{o}_{sol,1} / f^{o}_{sol,2};$$

$$I_{lub,i} = \left[1 - (1-\gamma_{lub})\mu^2_{lub} / (1+\gamma_{lub})(1+\mu_{lub})\right] I^{o}_{lub,i};$$

$$I_{sol,i} = \left[1 - (1-\gamma_{sol})\mu^2_{sol} / (1+\gamma_{sol})(1+\mu_{sol})\right] I^{o}_{sol,i},$$

the value $\langle\alpha\rangle = (\alpha_1 I_{sol,1} + \alpha_2 I_{sol,2}) / (I^{o}_{sol,1} + I^{o}_{sol,2})$ – is the average concentration of the solid components into «third body» volume [6].

The relative synergic effects are may be presented by following relations:

$$\delta_i = 4\alpha_i^2(1-\alpha_i)\left[1 - k_i(1-k_{n,i})\right] \cong 2\alpha_i^2(1-\alpha_i)$$

(for the velocity of linear wear) and

$\langle\delta\rangle = 2\langle\alpha\rangle^2(1-\langle\alpha\rangle)$ (for the friction coefficient).

It's need to note, this additive model of interacted «concentration waves» are may be used for prediction of CM tribologic properties in some systems [5, 7].

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RATIONAL TECHNOLOGICAL RESOURCE BASE AS MODEL OF INNOVATIVE DEVELOPMENT OF ENGINEERING EDUCATION

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The quality of modern engineering education (EE) is determined by fundamental training and aducation on the basis of the latest achievements of science. Imperative is creation of educational – scientific – production base (of technological resource base) training [1]. Technological resource base (TRB) is the basis for the formation of the technological subsystem of the university [2].

Conceptual positions on the formation of technological subsystems of system education of the university

1. *High importance of practical traning of the modern engineer.*

Distinctive feature of the present stage of development of EE is the increase in the importance of practical training of students. In structure of professional educational programs this kind of training has to make not less than 50-60% from the general budget of time.

2. *Strengthening of technological resource base – the strategic direction of development of engineering education.*

According to the Federal Target Programme for the Development of Education for 2013–2020 gg an increase in funding for education is provided. Thus the greatest sum of money is aimed to EE development. The increase in expenses at EE is connected first of all with strengthening of technological resource base: updating of the equipment, creation of computer and multimedia audiences, acquisition of the modern software, development of telecommunications, etc.

Such attention of the state to EE is related with the economy country; its technical potential entirely depends on efficiency and quality of engineering education.

3. *Technological resource base – a factor of efficiency and quality of EE.*

The state quality system includes quality control, of execution of the federal state educational standards of higher education, which set out the requirements for equipment of laboratories, computer laboratories, multimedia audiences, as well as to the quality of educational training services using TRB. This attention to quality TRB by the monitoring system state indicates its special importance in the learning process, which reflects its the bond with the efficiency and the quality of the EE.

All this allows you to progect the structure of the technological subsystem: educational equipment, scientific equipment, learning resources